

What is claimed is:

1. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the Mo occurs as dispersed Mo oxide clusters and the majority of the Co occurs in a  $\text{CoMoO}_4$ -like phase with the Co therein primarily in an octahedral configuration, and wherein the  $\text{CoMoO}_4$ -like phase occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a temperature between about  $700^\circ\text{C}$  and about  $800^\circ\text{C}$  and maintaining a  $\text{CO}_2$  concentration in the reactor below a threshold  $\text{CO}_2$  concentration above which the conversion of ionic Co to metallic Co is inhibited, wherein the majority of the single walled carbon nanotubes thus formed have a diameter between about .7 nm to about .9 nm.

2. The method of claim 1 wherein in the step of providing a catalyst, the support material is silica.

3. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.
4. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO<sub>2</sub> concentration in the reactor is 1%.
5. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon-containing gas is CO.
6. The method of claim 1 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.
7. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 1.

8. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the

Mo occurs as dispersed Mo oxide clusters and the majority of the

Co occurs in a  $\text{CoMoO}_4$ -like phase with the Co therein primarily in

an octahedral configuration, and wherein the  $\text{CoMoO}_4$ -like phase

occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a

temperature between about  $800^\circ\text{C}$  and about  $900^\circ\text{C}$  and

maintaining a  $\text{CO}_2$  concentration in the reactor below a threshold

$\text{CO}_2$  concentration above which the conversion of ionic Co to

metallic Co is inhibited, wherein the majority of the single walled

carbon nanotubes thus formed have a diameter between about .9

nm to about 1.2 nm.

9. The method of claim 8 wherein in the step of providing a catalyst, the support material is silica.

10. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.

11. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO<sub>2</sub> concentration in the reactor is 1%.
12. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon containing gas is CO.
13. The method of claim 8 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.
14. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 8.

15. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the Mo occurs as dispersed Mo oxide clusters and the majority of the Co occurs in a  $\text{CoMoO}_4$ -like phase with the Co therein primarily in an octahedral configuration, and wherein the  $\text{CoMoO}_4$ -like phase occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a temperature between about  $900^\circ\text{C}$  and about  $1,000^\circ\text{C}$  and maintaining a  $\text{CO}_2$  concentration in the reactor below a threshold  $\text{CO}_2$  concentration above which the conversion of ionic Co to metallic Co is inhibited, wherein the majority of the single walled carbon nanotubes thus formed have a diameter between about 1.3 nm to about 1.7 nm.

16. The method of claim 15 wherein in the step of providing a catalyst, the support material is silica.

17. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.

18. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO<sub>2</sub> concentration in the reactor is 1%.

19. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon-containing gas is CO.

20. The method of claim 15 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.

21. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 15.